

ASTRONOMY 110 - EXOPLANETS

Fall 2024

Instructor:	John Johnson	Time:	Tu,Th 1:30 – 2:45
Contact:	jjohnson@cfa.harvard.edu	Place:	Scinece Center 112
Office:	P-340, Center for Astrophysics (CfA)		

Final Exam Information

TBD

Teaching Fellows

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Course Page

[Canvas](#)

Course Description

A survey of the rapidly-evolving field of the detection and characterization of planets orbiting other stars. Topics includes proto-stellar collapse and star formation; protoplanetary disk structure; models of planet formation; methods of detecting extrasolar planets; composition and physical structure of planets; planetary atmospheres; habitable zones; greenhouse effect; and biosignatures.

Recommended Preparation/Prerequisites

An introductory course in mechanics, which may be taken concurrently, satisfied by Physics 11a, Physics 15a, Physics 16 or Physical Sciences 12a. These requirements are already satisfied with Astron 16.

Tentative Course Outline

Weeks 1-3: The Wheels of the Planetary System Go Round and Round: Keplerian orbits, Deriving Kepler's Laws, N-body integration

Weeks 4-7: How Do You Find An Exoplanet? Doppler technique, transits, transit timing, microlensing, imaging

Weeks 8-10: Know Thy Star, Know Thy Planet: From the physics of stars to the physical properties of planets.

Weeks 11-12: Planetary atmospheres

Weeks 12-14: Habitability Here and Abroad

Assignments and Grading Procedures

The course will be composed of class participation (40%), 3 midterm exams and a final exam (40%), and a final project where you will “adopt a planet” and write an engaging [astrobites](#) style report about it (20%).

Resources

Questions? Email any member of the teaching staff. Be aware that teaching staff cannot instantaneously respond to your request, so leave plenty of time for your email to be answered before deadlines. Make sure your email contains at least one clearly-worded question or request, and sufficient text to provide context for your question or request.

Texts

How Do You Find an Exoplanet? - John Johnson - required

Exoplanets - Sara Seager - recommended

An introduction to modern astrophysics (2nd Ed.) - Carroll & Ostlie - optional

Astrophysics in a nutshell - Maoz - optional

Street-fighting Mathematics - Mahajan - optional

Class Activities

Students will spend the majority of class time on active, collaborative learning. Each week will feature a worksheet designed to walk students through key concepts of a specific subject area. Students will work in small groups of 2 to 4 individuals at a chalkboard/whiteboard, stepping through each problem on the worksheet. Students will also engage in discussions around current discoveries in exoplanet research and their implications for the field as a whole.

Exams

There will be 3 in-class midterm exams and an in-class final. Each midterm will cover material on the previous handout and the final will be a cumulative exam. All material contained in Class Activity worksheets (see previous section) is eligible for inclusion on exams. Exams will contain no new material, but may contain questions covering the Class Activity material in slightly new ways. As such, conceptual learning is key; memorization will be largely useless.

Academic Integrity

Any material submitted to meet course requirements—homework assignments, papers, projects, examinations—is expected to be a student's own work. Collaboration on studying and on homework assignments is encouraged, but you must ensure that anything submitted is the result of your own work and reflects your own approach to the topic. Students must acknowledge the input of any collaborators when submitting work.

Statement on the use of AI

I'm assuming you took this course to learn astrophysics, as a human, rather than depending on, or demonstrating the artificial learning of an algorithm such as ChatGPT. That said, I'm expected to have an official statement in this syllabus, so here it is: The course instructional team expects that all work students submit for this course will be their own. In instances when collaborative work is assigned, we expect for the assignment to list all team members who participated. We specifically forbid the use of ChatGPT or any other generative artificial intelligence (AI) tools at all stages of the work process, including preliminary ones. Violations of this policy will be considered academic misconduct. We draw your attention to the fact that different classes at Harvard could implement different AI policies, and it is the student's responsibility to conform to expectations for each course.

Accommodations For Students With Disabilities

If you have any kind of disability, whether apparent or non-apparent, learning, emotional, physical, or cognitive, and you need some accommodations or alternatives to lectures, assignments, or exams, please feel free to contact me to discuss reasonable accommodations for your access needs. The earlier you contact me in the semester, the easier it will be for both of us. I encourage you to work with University Disability Services for Harvard College (Accessible Education Office, Smith Campus Center, Suite 470, 1350 Mass. Ave, 617-496-8707, aeo@fas.harvard.edu). I would appreciate but do not require, a letter from them; I understand that requiring a letter may place an undue burden on you I am also happy to work directly with University Disability Services if that is easier for you.